

## ALGEBRA AND THE LOW I. Q.

BY

E. H. CAMERON

*University of Illinois, Urbana.*

One of the most difficult as well as most important problems confronting those interested in education is that of knowing what is the wisest treatment to give any individual pupil at each stage as he progresses from grade to grade through the elementary school, high school, and college. It would appear that there must be a stage for every individual pupil after which further continuance at school ceases to be profitable either for himself or society. But the profits of education are so intangible, and our means of estimating results so imperfect, that it is impossible in the present state of our knowledge of the subject to determine when a given course of study will be profitable for any given individual pupil.

It is not surprising that under these circumstances we should find that the educational world is divided into two opposing camps concerning the philosophical basis for determining how much formal education should be given to our young people in relation to this supposed intellectual ability. On the one hand, we have such statements as those of Dewey who says:

"How much one pupil differs from another in intelligence is none of the teacher's business. It is irrelevant to his work."

On the other hand, we have the point of view expressed by Tait:

"All this conversation about education reconstructing the universe of human nature, as a result of sending youths to school and college in ever-increasing numbers, requires some considerable revision. A great proportion of these receive no education and less training. The time, money, and energy spent upon them is so much waste, and it is no small wonder that education is costing so much, and too much."<sup>1</sup>

The tremendously increased attendance in high schools and colleges in recent years has undoubtedly aggravated conditions. Everywhere, we find high-school teachers complaining that there are too many pupils going on to high-school work who should never have entered high school, and college and university professors are constantly lamenting the fact that so much time and energy have to be devoted to students who by the very nature of things cannot profit from higher education.

<sup>1</sup>W. D. Tait, McGill University. "Education as Selective," *School and Society*, XXXI, April 19, 1930. p. 522.

Thorndike has estimated that "if we set the median intellect as the minimum able to profit by the study of algebra," then 95 per cent of the high-school population of 1890 was able to profit by this study, but the increase in attendance between 1890 and 1918 was so great that at this later date only 83 per cent of the pupils would profit by the study of algebra if the same criterion were taken. Since the high-school population has approximately doubled since 1918 it is probable that on the same basis not more than 75 per cent of high-school pupils profit by the study of algebra. Of course, the assumption that an average intellect is the intellect that can profit from such study cannot be demonstrated, but high-school teachers unquestionably conscientious and devoted to their calling are in increasing numbers throwing up their hands in distress at what they term the total impossibility of doing anything worth while for a large percentage of their pupils in their study of traditional subjects.

It would be a step, though a very short one, toward the solution of this problem if we could say with more definiteness just how much of a given subject matter of instruction is fairly mastered by a given grade of intellect. It was this thought that led me to engage in a little study of this matter in the Champaign High School in relation to the study of algebra. But the usual method of class procedure is not well adapted to answering the question raised. A passing grade of the ordinary sort reveals very little as to how much of a given subject a student has learned.

Accordingly, with the cooperation of Mr. Allison, the principal, and Miss Bamberger, the teacher, those pupils who after a month's work in algebra were apparently failing were placed in a class by themselves and taught by the individual method and allowed to progress at their own rate. It is entirely possible under such circumstances to determine somewhat definitely how much a given pupil can accomplish in a given length of time.

This special class of pupils in algebra enrolled thirty members. At the present date it numbers fifteen. Five have withdrawn from school entirely, and ten have withdrawn from the study of algebra, preferring to drop this subject and spend their time in the attempt to pass their other subjects. Of the remaining fifteen, three have finished in the course of a year about the equivalent of a semester's work, and none of the others have attained enough facility in the relatively mechanical processes of addition, subtraction, multiplication, and division to say that these processes have been mastered. Three are working at page 23 of the textbook, which covers merely the introduction. Standardized tests on the fundamental processes in algebra confirm the truth of this diagnosis.

As was stated earlier, it was hoped as a result of this study that it might be possible to relate the amount and proficiency of the work done to the I.Q. of these pupils, so that there might be some evidence that a certain grade of intellect might be expected to attain such or such a degree of proficiency in algebra in the course of a year's instruction.

Much to my surprise, the I.Q.'s of these pupils show very little relationship to the degree of accomplishment. At the beginning of the year, Miss Bamberger made the statement that these pupils could do the work if they tried. The intelligence tests and achievements tests given to this special class and to a class taught by the same teacher show that she was fundamentally correct in her diagnosis of the situation. For practically every I.Q. in the division each member of which is utterly failing there can be found an I.Q. in the division taught by the same teacher each member of which is succeeding. It is true that the members of the successful division with the very highest I.Q.'s in general stand highest in the achievement tests. It is also true that the pupils in the unsuccessful division with the lowest I.Q.'s have made in general the least progress. But the range of I.Q. in the successful division is from 90 to 119, while that in the failing division is from 82 to 114. The median I.Q. for the successes is 108 and for the failures 104. For all but the two lowest I.Q.'s in the failing division can be found a pupil in the succeeding division with the same I.Q. In general, it may be said that so far as the pupils included in this study are concerned the cause of failure must be regarded as low P.Q. (Perseverance Quotient) rather than low I.Q. How typical the conditions are which are represented amongst the small number of students reported in this study is impossible to say, but it seems clear that for this particular group of fifteen students the study of algebra has not been profitable. So low a degree of proficiency as they have attained in the manipulation of algebraic symbols in the course of a year has not been profitable for themselves or anybody else concerned in the matter, and at least for them the difficulty standing in the way of relatively successful attainment is not so much lack of adequate intelligence as of lack of something that for want of a better name may be called perseverance.

What conditions the schools may create to arouse in such pupils a proper attitude toward the work of the school is an interesting question, the answer of which I shall not attempt. Undoubtedly, every individual represented in this group represents a unique case requiring a particular remedial treatment. In my opinion the possibility of changing the Perseverance Quotient is neither more hopeful nor more hopeless than that of changing the I.Q. Perhaps some of you have read that

somewhat remarkable book, "Four Square," by John R. Oliver, in which he says:

"When I began my work in the courts as a baliff psychiatrist, it was the hey-day of mental tests. No case report was complete without a carefully estimated intelligence coefficient."

After telling of his experience of these tests in relation to court work, he goes on to say:

"And that brings me back to one of the fundamental results of my own court experience, namely, that every case of delinquency is an individual case and must be approached from an individual standpoint."

The easy way out of the difficulties that confront the schools in relation to such pupils as this report has described is their elimination from school. For various reasons, this easy method is not feasible under present social conditions. In the first place, it is true that, notwithstanding the severe criticisms to which our educational procedures and organization are being continually subjected, Americans generally have a deep faith in the value and efficiency of education, and continue to send their young people to school for longer and longer periods. In the second place, the American public in general is so well off financially that young people are no longer required to enter financially gainful pursuits at as early an age as formerly. The desirability of thus postponing the entrance of our youth upon independent economic careers is made more emphatic by the increasing span of life of the older generation and the consequent longer periods of productive work on the part of this class of our citizens. It is, therefore, not surprising that there are few signs that the schools will be relieved from the pressure of numbers for some time to come. If we are to accommodate ourselves to such conditions, we must provide for the skillful study of individual cases, and for remedial treatment; and if this is done it seems safe to say that there will be a large percentage of our high-school pupils who will not be required to take algebra.